Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

1/15

FIG. 1

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
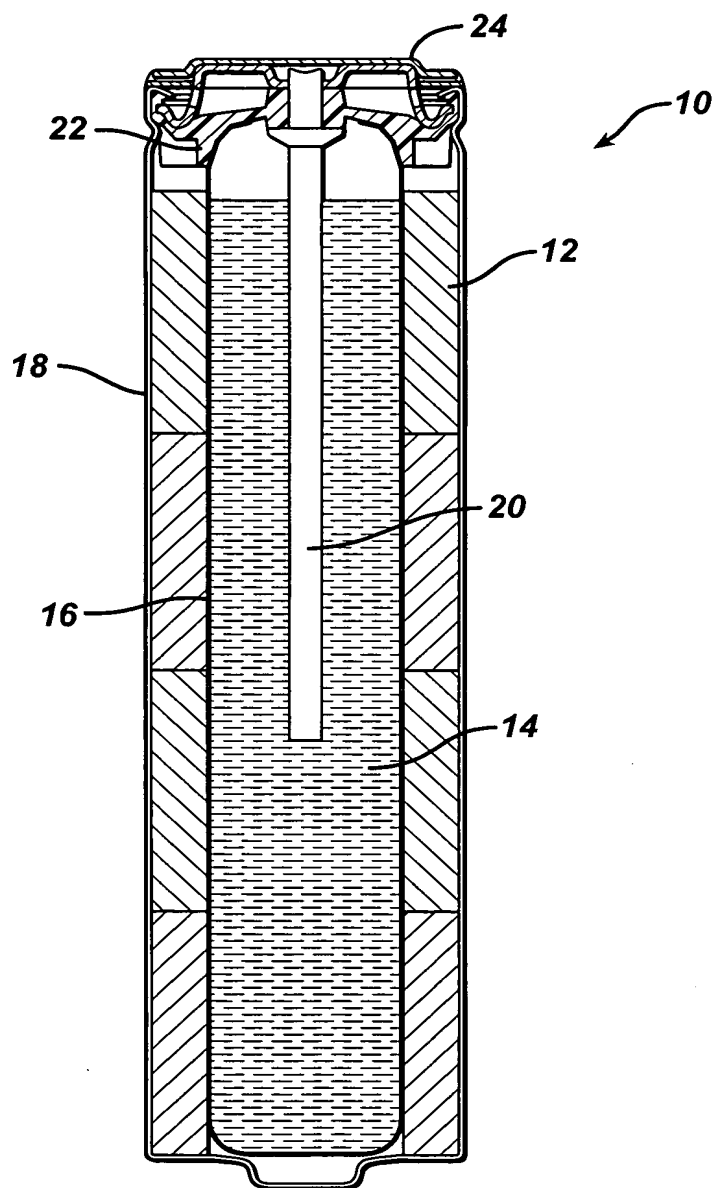PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

2/15

FIG. 2

Theoretical Volumetric Capacities and Energy Densities (total cell)
for 1.5V alkaline zinc cells containing metal bismuth oxides.

Cathode Material	Electrons per formula unit	Theoretical Specific Capacity (mAh/g)	Average CCV (V)	Density (g/cm³)	Theoretical Volumetric Capacity (Ah/cm³)	Theoretical Energy Density (total cell)[a] (Wh/L)
$KBiO_3$	2	181	1.65	5.87	1.06	1483
$AgBiO_3$	3	220	1.4	8.18	1.80	1930
$ZnBi_2O_6$	4	185	1.65	8.44	1.56	2035
$MgBi_2O_6$	4	199	1.68	7.92	1.58	2088
$CdBi_2O_6$	4	171	$(1.5)^b$	$(8.2)^b$	1.40	1698
$Cu_2Bi_2O_7$	6	245	$(1.4)^b$	$(8.2)^b$	2.01	2093

[a] assuming discharge capacity of cathode and anode balanced
[b] estimated value

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

3/15

FIG. 3

Example	M =	Calculated (weight percent)				Observed (weight percent)			
		Na	Co	M	Bi	Na (ppm)	Co	M	Bi
1a	Zn	0	0	11.29	72.14	81	---	10.85	65.88
1b	Zn	0	1.92	10.95	69.98	75	1.46	8.09	66.22
2a	Mg	0	0	4.52	77.65	---	---	---	---
2b	Mg	0	1.92	4.38	75.32	<34	1.95	4.05	68.00
3	Cu	0	0	19.34	63.61	<44	---	14.45	60.29
4	Ag	0	0	29.57	57.28	7200	---	27.66	52.73

"___" = not analyzed

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

4/15

FIG. 4

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

5/15

FIG. 5

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

6/15

FIG. 6

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
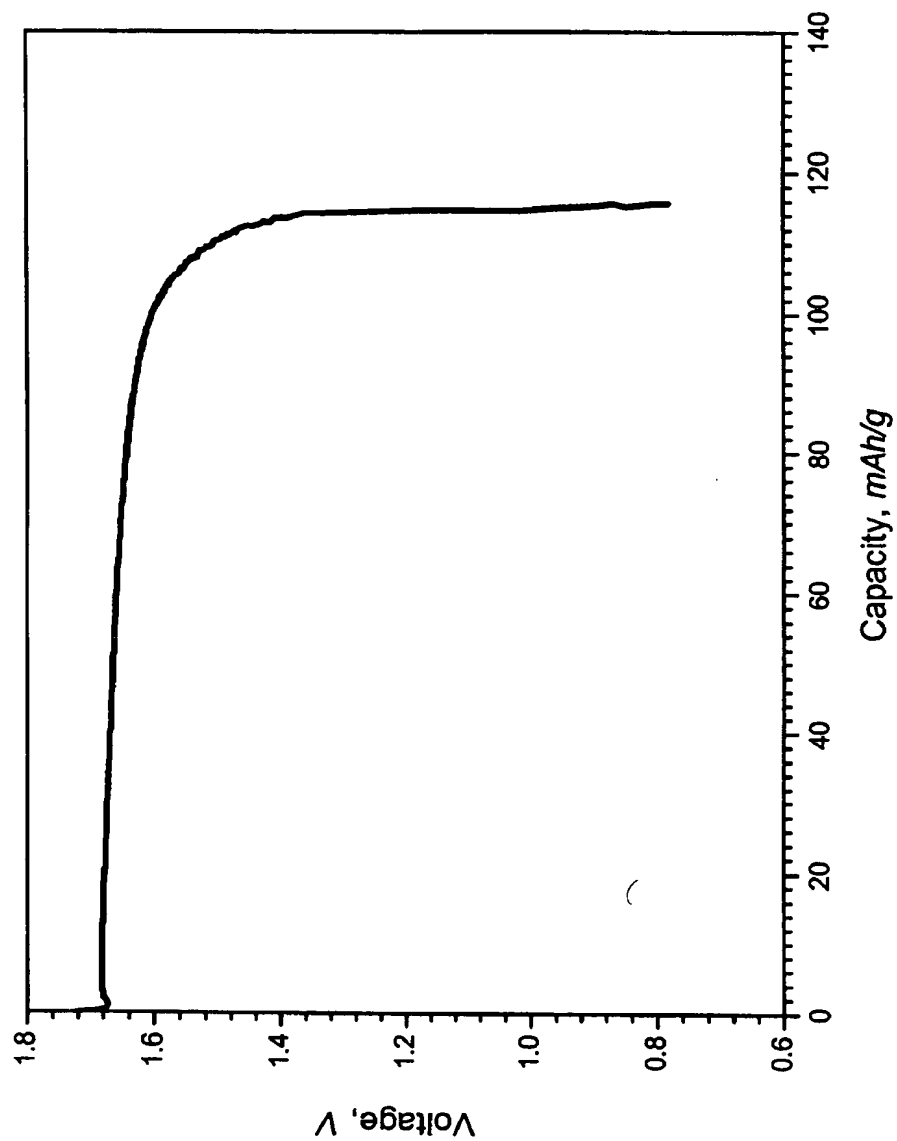PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

7/15

FIG. 7

Example	Cathode Material	Low-rate Capacity To 0.8 V (mAh/g)	Percent Utilization	Low-rate Capacity To 0.6 V (mAh/g)	Percent Utilization	High-rate Capacity To 0.8 V (mAh/g)	Percent Utilization	High-rate Capacity To 0.6 V (mAh/g)	Percent Utilization
1a	$ZnBi_2O_6$	30	16	ND	ND	ND	ND	ND	ND
1b	CoOOH-coated $ZnBi_2O_6$	102	55	335	72	58	31	ND	ND
2a	$MgBi_2O_6$	77	40	309	62	85	43	300	60
2b	CoOOH-coated $MgBi_2O_6$	116	58	345	68	89	45	310	60
3	$Cu_2Bi_2O_7$	50	20	360	63	35	14	170	30
4	$AgBiO_3$	170	77	310	70	165	75	360	81
5a	$KBiO_3$	100	55	357	79	70	39	315	69
5b	CoOOH-coated $KBiO_3$	105	58	375	83	80	45	205	45
C1	$NaBiO_3$	20	10	325	74	ND	ND	ND	ND
C2	Bi_2O_4	20	18	336	75	0	0	360	81
C3	Bi_2O_3	0	0	260	75	0	0	155	45

ND = not determined

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

8/15

FIG. 8

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

9/15

FIG. 9

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

10/15

FIG. 10

Capacity, mAh/g

Voltage, V

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

11/15

FIG. 11

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

12/15

FIG. 12

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

13/15

FIG. 13

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

14/15

FIG. 14

Matter No.: 08935-295001
Applicant(s): Xiandong Wang, et al.
PRIMARY ALKALINE BATTERY CONTAINING BISMUTH METAL OXIDE

15/15

FIG. 15